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(19) (CA) **APPLICATION FOR CANADIAN PATENT** (12)

(54) Apparatus and Method for Double Shoot Sowing of Seed
and/or Fertilizer

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(71) Same as inventor

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ABSTRACT

The invention disclosed is a method for single or double shoot sowing of seed and/or fertiliser wherein two parallel lines of seed and/or fertiliser are deposited at different depths without substantial, unwanted, disruption of the surface soil, and an apparatus used in conjunction with a conventional furrow opener and material depositor that creates a furrow with at least one edge wall. The apparatus has a cutting edge that cuts a lateral furrow in an edge wall of a first furrow, a deflecting surface that covers first material deposited in the first furrow with soil from the lateral furrow, and a conduit that deposits second material along a line above, parallel, and adjacent to the line.

Apparatus and Method For Double Shoot Sowing of Seed and/or Fertilizer.

Double shoot sowing of seed and/or fertiliser is well known.

Typically however the second of the materials to be sown is delivered a substantial distance behind the first so as to permit the soil to fall into the first furrow and cover the first material with or
5 without assistance from various blades or plow-like devices between the two discharge orifices. Such devices are not widely used particularly in dry land farming where disruption of the soil both at the surface and below is to be avoided. Further, such devices typically do not provide for either a good contact with the soil, good coverage, or a specified and narrowly confined path of disposition. Scatter and lack of definition can be reduced by selective packing or firming of the
10 seed bed. Such methods often do not provide for enough control of the variables of depth, position, soil contact, soil firmness and fracturing.

One known method is to provide for seed to be deposited in the wake of a sweep, which may be large or small, whereby soil is forced up and over the sweep to create a passage for the additional lateral seed deposition. All of these methods cause an increased and undesirable soil disruption or
15 fracturing above the sweep while having too little impact on the first furrow and the seed bed itself. Many require a sharp angle in the seed delivery tubes which can cause damage to seed and/or other particulate materials delivered at high speed in modern air seeding apparatus.

Another known method to try to solve these problems is shown in USP 4,674,419 issued 23 Jun 87 to I.D. Kopecky which provides for a horizontally and downwardly disposed sealer plate
20 immediately to the rear of the conventional shank which compacts the soil at the edge of the first furrow in a downward direction with the intent of providing a firm horizontal but laterally displaced seed bed and of causing the vertically compacted soil to fill the first furrow. Extensions of the sealer plate form narrow grooves for disposition of the seed at either lateral edge of the plate and which may further fracture the vertically compacted soil and move same towards the center.
25 Such a design requires additional delivery tubes for the seed which are shown to be external of the sealer plate and thus further disruptive of the critical surface soil and lead to clogging in wetter or clay conditions.

It is an object of the present invention to provide a double-shoot opener for attachment to a conventional vertically oriented shank furrow opener in close proximity to the said shank, which
30 opener cuts a second or lateral furrow in the side wall of the first furrow by displacing the side wall soil inwardly to cover first material placed by said shank without substantial unwanted disruption of the surface soil, and which provides a high degree of definition and control of the location of the two materials.

The invention thus consists in a ground opener adapted for use in conjunction with a conventional
35 furrow opener that creates a furrow with at least one edge wall when operating, said furrow opener having a main axis lying in a substantially vertical plane in the direction of travel, said ground opener comprising:

- a) upper and lower surfaces each lying in planes:
 - i. disposed at a substantial angle to the vertical,
 - 40 ii. substantially parallel to the direction of travel,

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- iii. intersecting said vertical plane along a horizontal line at or below the level of the ground when in working position, and parallel to the direction of travel,
- b) a forward cutting edge in said upper surface:
 - i. disposed at an angle substantially less than 90 degrees with respect to the said horizontal line so as to taper outwardly in a direction opposite to the direction of travel,
 - ii. adapted to cut into an edge wall created by an associated furrow opener,
- c) a soil deflecting front surface, depending from and including the said cutting edge, disposed to deflect soil substantially inwardly towards said vertical plane when in the working position,
- d) conduit means between said upper and lower surfaces to conduct material from receiving means in said ground opener to outlet means substantially laterally spaced from said plane, to deposit said material within said edge wall.

The invention further comprises a double-shoot ground opener adapted for use in conjunction with a conventional furrow opener that creates a furrow with at least one vertical edge wall when operating, said furrow opener having:

- 1. a main axis lying in a substantially vertical plane in the direction of travel,
 - 2. conduit means to conduct a first material to first outlet means proximate said vertical plane,
 - 3. means adjacent said plane to attach said ground opener rearwardly of said furrow opener in close association therewith,
- said ground opener comprising:
- a) upper and lower surfaces each lying in planes:
 - i. disposed at a substantial angle to the vertical,
 - ii. substantially parallel to the direction of travel,
 - iii. intersecting said vertical plane along a horizontal line at or below the level of the ground when in working position, and parallel to the direction of travel,
 - b) a forward cutting edge in said upper surface:
 - i. disposed at an angle substantially less than 90 degrees with respect to the said horizontal line so as to taper outwardly in a direction opposite to the direction of travel,
 - ii. adapted to cut into a vertical edge wall created by an associated furrow opener,
 - c) a soil deflecting front surface, depending from and including the said cutting edge, disposed to deflect soil substantially inwardly towards said vertical plane when in the working position,
 - d) conduit means between said upper and lower surfaces to conduct second material from receiving means in said ground opener to second outlet means substantially laterally spaced from said plane, to deposit said material within said lateral edge wall.

The invention further comprises a method for the application of seed or fertiliser comprising:

- a) opening in soil a conventional furrow with at least one edge wall,
- b) cutting a laterally displaced side-wall furrow into the said edge wall below the soil surface,
- c) substantially simultaneously deflecting soil cut from said side-wall furrow primarily laterally into said conventional furrow,
- d) depositing a seed or fertiliser material into said side-wall furrow.

The invention further comprises a method for double shoot application of seed and fertiliser comprising:

- a) opening in soil a conventional furrow with at least one substantially vertical edge wall,
- b) depositing a first seed or fertiliser material at the bottom of said conventional furrow,
- 5 c) cutting a laterally displaced side-wall furrow into the said vertical edge wall, above the deposited first material and below the soil surface,
- d) deflecting soil cut from said sidewall furrow to cover said first material,
- e) depositing a second seed or fertiliser material above the deflected soil along a line laterally displaced from the line of deposit of said first material.

10 The accompanying drawings show, in:

Figure 1, Side Elevation of the Opener of the invention

Figure 2, Rear Elevation of the Opener of Figure 1

Figure 3, Front Elevation of the Opener of Figure 1 (shown without connecting tabs shown in Figure 2)

15 Figure 4, Bottom View of the Opener of Figure 1

Figures 5a and 5b, side elevation and corresponding rear view of the opener of Figure 1 (shown in working position in conjunction with a traditional furrow shank opener.)

The preferred embodiment of the opener of the invention is shown in Figures 1-5.

As shown in Figure 5 the double shoot opener of the invention is generally designated 28. Opener 20 28 is shown in working position attached immediately to the rear of conventional shank furrow ground opener 18. As shown in Figure 5a, conventional ground furrow opener 18 has cutting side walls 25 and point 26. Opener 18 cuts a vertical furrow to depth 21 in a conventional manner. A typical soil surface is shown at 5. Ground opener 18 includes an internal path 19 for a first material to be sown, such as seed and/or fertiliser which may, for example, be delivered by 25 moving air from an air seeder or by gravity. This first material follows path of arrow 20 while inside the opener 18. The first material is discharged from the lower extremity of opener 18 into the furrow at depth 21 to follow path indicated by arrow 22.

As the conventional opener 18 travels through the soil while working from right to left in figures 1 and 5, the soil follows path of arrow 27, Figures 1, 4, and 5, in relation to the double shoot opener 30 28.

Substantially parallel upper and lower surfaces of opener 28, 4 in Figure 1, and 6 in Figure 4, respectively, lie in planes that are each substantially parallel to the direction of travel when in the working position and are, preferably, planar. The plane of upper surface 4 meets the generally vertical side wall 14 of opener 28 at an obtuse angle along a horizontal line 15 which is both 35 parallel to the direction of travel and at or, preferably, below the surface of the ground 5 when in the working position.

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A forward cutting edge 1 of opener 28, incorporated into upper surface 4, diverges from the horizontal line 15 at an angle substantially less than 90 degrees and extends laterally outward from the body of opener 28.

A deflecting surface 2, Figure 4, extending rearwardly from cutting edge 1 between upper and lower surfaces 4 and 6, incorporates cutting edge 1 and is oriented at an angle of about 15 to 25 degrees to upper surface 4 so as to deflect soil primarily inwardly into the conventional furrow immediately to the rear of ground opener 18.

Cutting edge 1 and deflecting surface 2 co-operate so as to cut a laterally displaced furrow, (not shown) completely beneath the surface of the ground 5, into the vertical side wall of the conventional furrow cut by vertical side walls 25 of ground opener 18. The soil in which this lateral furrow is formed is displaced inwardly into the conventional trench without substantial fracturing or compression.

Figures 2 and 3 show a rear and front view respectively of the opener 28. Since upper surface 4 is parallel to the direction of travel, soil in region A is relatively undisturbed or unfractured by the opening of the lateral furrow. Deflecting surface 2, Figure 3, impacts upon the soil cut from the lateral furrow and causes that soil to be folded into the conventional furrow in the direction of arrow 29 which is primarily inwardly but also downwardly. Thus, area B is filled with soil to cover up first material sown along path 22 without substantial compression of either of this material or the soil immediately below lower surface 6 of the opener 28 and outside of the conventional furrow.

Opener 28 may be attached to conventional opener 18 as by tabs shown at 30 in Figure 2, not shown elsewhere for clarity of drawing.

The second material, such as seed, enters opener 28 at 12 in a conventional manner and follows path 13 to exit orifice 10. Orifice 10 is horizontally oriented as shown in Figure 1. Preferably path 13 is curved rearwardly for compactness of the opener.

Seed path 13 is between upper surface 4 and lower surface 6 so as to be laterally displaced from vertical plane 31, figures 2 and 3, before exiting the opener at orifice 10 to follow path 11. Path 11 is shown in figures 2 and 3 without the effect of soil in the bottom on the lateral furrow for clarity of drawing.

Preferably upper surface 4 is terminated laterally with a vertical edge surface 3 at its outer limit which optionally may extend downwardly to meet and terminate at lower surface 6. Vertical surface 3 meets deflecting surface 2 along line 3a in Figure 1.

Also, opener 28 optionally may include a V-shaped projection 32 formed by a short inclined plane surface 7 intersecting vertical edge surface 3 and, at the apex of 32, lower face 6 which is intersected along the center line 8 of orifice 10, Figure 4. The rear surface 9 of V-shaped projection 32 may be sloped forwardly, as shown in Figures 1 and 4, to provide a smooth seed path 11.

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As shown in Figures 5a and 5b the seed is deposited in the laterally displaced furrow at depth 23 in a path 24 which is well defined by reason of V-shaped projection 32.

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What is claimed is:

1. A ground opener adapted for use in conjunction with a conventional furrow opener that creates a furrow with at least one edge wall when operating, said furrow opener having a main axis lying in a substantially vertical plane in the direction of travel, said ground opener comprising:
 - 5 a) upper and lower surfaces each lying in planes:
 - i. disposed at a substantial angle to the vertical,
 - ii. substantially parallel to the direction of travel,
 - iii. intersecting said vertical plane along a horizontal line at or below the level of the ground when in working position, and parallel to the direction of travel,
 - 10 b) a forward cutting edge in said upper surface:
 - i. disposed at an angle substantially less than 90 degrees with respect to the said horizontal line so as to taper outwardly in a direction opposite to the direction of travel,
 - ii. adapted to cut into an edge wall created by an associated furrow opener,
 - c) a soil deflecting front surface, depending from and including the said cutting edge, disposed to
- 15 deflect soil substantially inwardly towards said vertical plane when in the working position.
- d) conduit means between said upper and lower surfaces to conduct material from receiving means in said ground opener to outlet means substantially laterally spaced from said plane, to deposit said material within said edge wall.
2. An opener as claimed in claim 1 wherein the outlet means is rearward of the said soil
- 20 deflecting surface.
3. An opener as claimed in claims 1 or 2 wherein one or more of the upper, lower and front surfaces are substantially planar.
4. An opener as claimed in claim 3 wherein the opener further comprises:
 - a) a substantially vertical outer edge extending downwardly from said upper surface,
 - 25 b) a V-shaped downward projection extending from said vertical outer edge to said lower surface between said soil deflecting surface and said second outlet.
5. A double-shoot ground opener adapted for use in conjunction with a conventional furrow opener that creates a furrow with at least one vertical edge wall when operating, said furrow opener having:
 - 30 1. a main axis lying in a substantially vertical plane in the direction of travel,
 2. conduit means to conduct a first material to first outlet means proximate said vertical plane,
 3. means adjacent said plane to attach said ground opener rearwardly of said furrow opener in close association therewith,
- said ground opener comprising:
 - 35 a) upper and lower surfaces each lying in planes:
 - i. disposed at a substantial angle to the vertical,
 - ii. substantially parallel to the direction of travel,
 - iii. intersecting said vertical plane along a horizontal line at
 - 40 or below the level of the ground when in working position, and parallel to the direction of travel,
 - b) a forward cutting edge in said upper surface:

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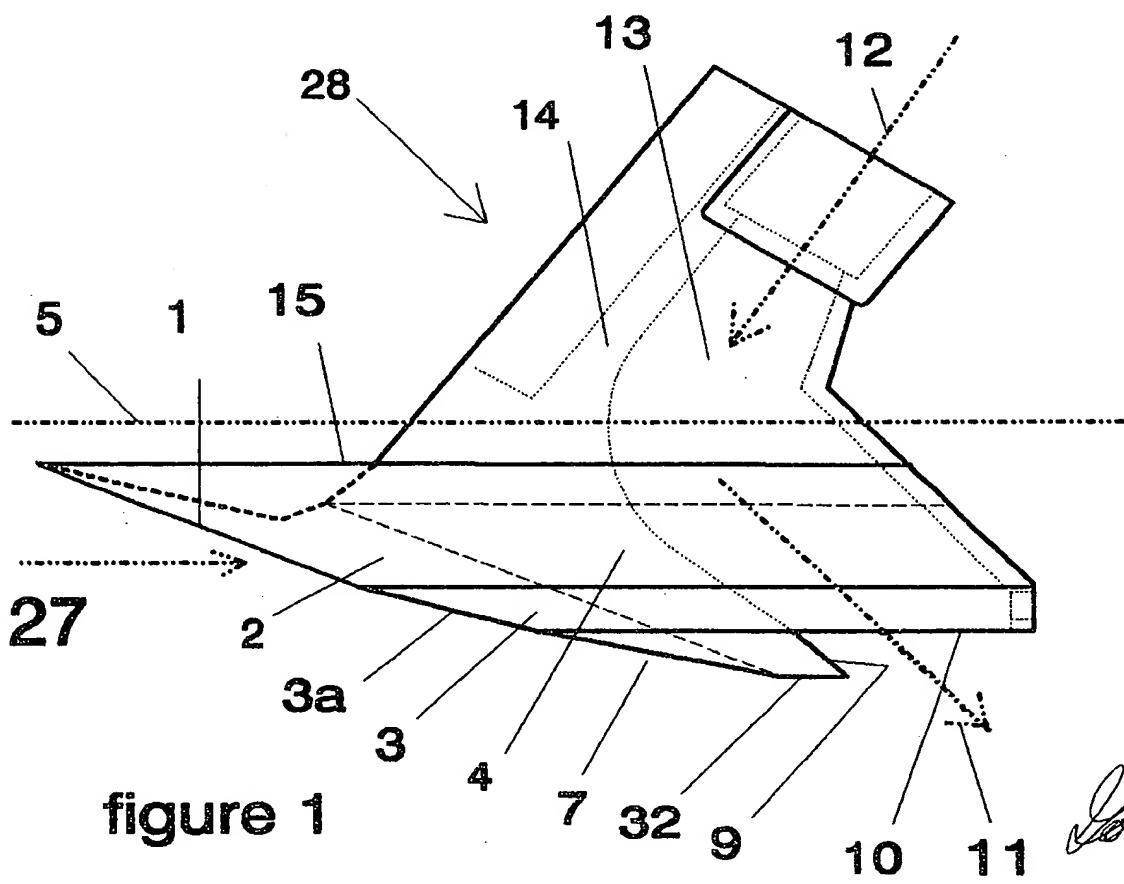
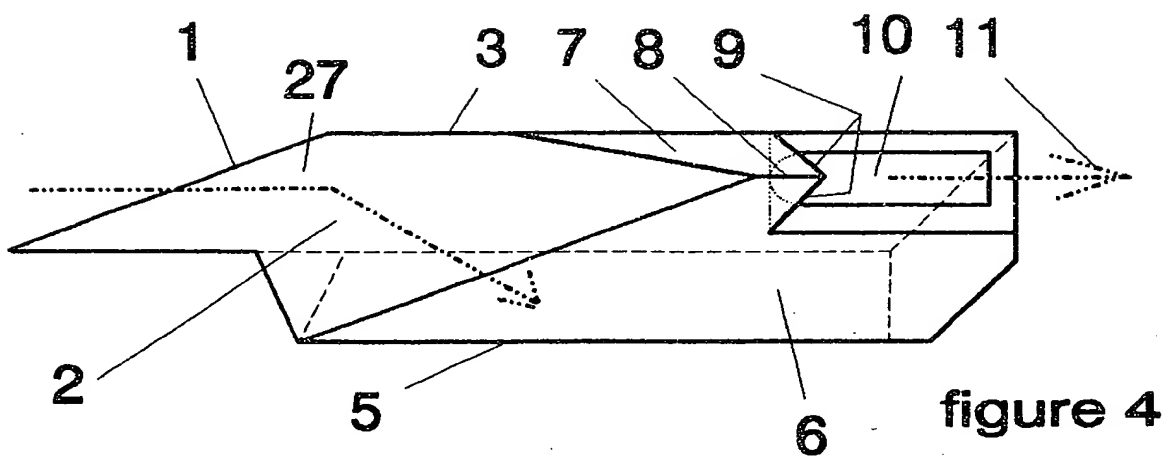
- i. disposed at an angle substantially less than 90 degrees with respect to the said horizontal line so as to taper outwardly in a direction opposite to the direction of travel,
 - ii. adapted to cut into a vertical edge wall created by an associated furrow opener,
- 5 c) a soil deflecting front surface, depending from and including the said cutting edge, disposed to deflect soil substantially inwardly towards said vertical plane when in the working position,
- d) conduit means between said upper and lower surfaces to conduct second material from
- 10 receiving means in said ground opener to second outlet means substantially laterally spaced from said plane, to deposit said material within said lateral edge wall.
- 6. An opener as claimed in claim 5 wherein the soil deflecting surface is a single surface.
- 7. An opener as claimed in claim 6 wherein the outlet means is rearward of the said soil deflecting surface.
- 15 8. An opener as claimed in claims 6 or 7 wherein one or more of the upper, lower and front surfaces are substantially planar.
- 9. An opener as claimed in claim 8 wherein the opener further comprises:
 - a) a substantially vertical outer edge extending downwardly from said upper surface,
- 20 b) a V-shaped downward projection extending from said vertical outer edge to said lower surface between said soil deflecting surface and said second outlet.
- 10. A method for the application of seed and fertiliser comprising:
 - a) opening in soil a conventional furrow with at least one edge wall,
 - 25 b) cutting a laterally displaced side-wall furrow into the said edge wall below the soil surface,
 - c) substantially simultaneously deflecting soil cut from said side-wall furrow primarily laterally into said conventional furrow,
 - d) depositing a seed or fertiliser material into said side-wall furrow.
- 11. A method as claimed in claim 10 wherein said edge wall is substantially vertical.
- 30 12. A method for the double shoot application of seed and fertiliser comprising:
 - a) opening in soil a conventional furrow with at least one substantially vertical edge wall,
 - b) depositing a first seed or fertiliser material at the bottom of said conventional furrow,
 - c) cutting a laterally displaced side-wall furrow into the said vertical edge wall, above the deposited first material and below the soil surface,
 - 35 d) substantially simultaneously deflecting soil cut from said side-wall furrow primarily laterally to cover said first material,
 - e) depositing a second seed or fertiliser material above the deflected soil along a line laterally displaced from the line of deposit of said first material.

13. A method as claimed in claim 12 wherein the first material is deposited through the means used to open the conventional furrow.

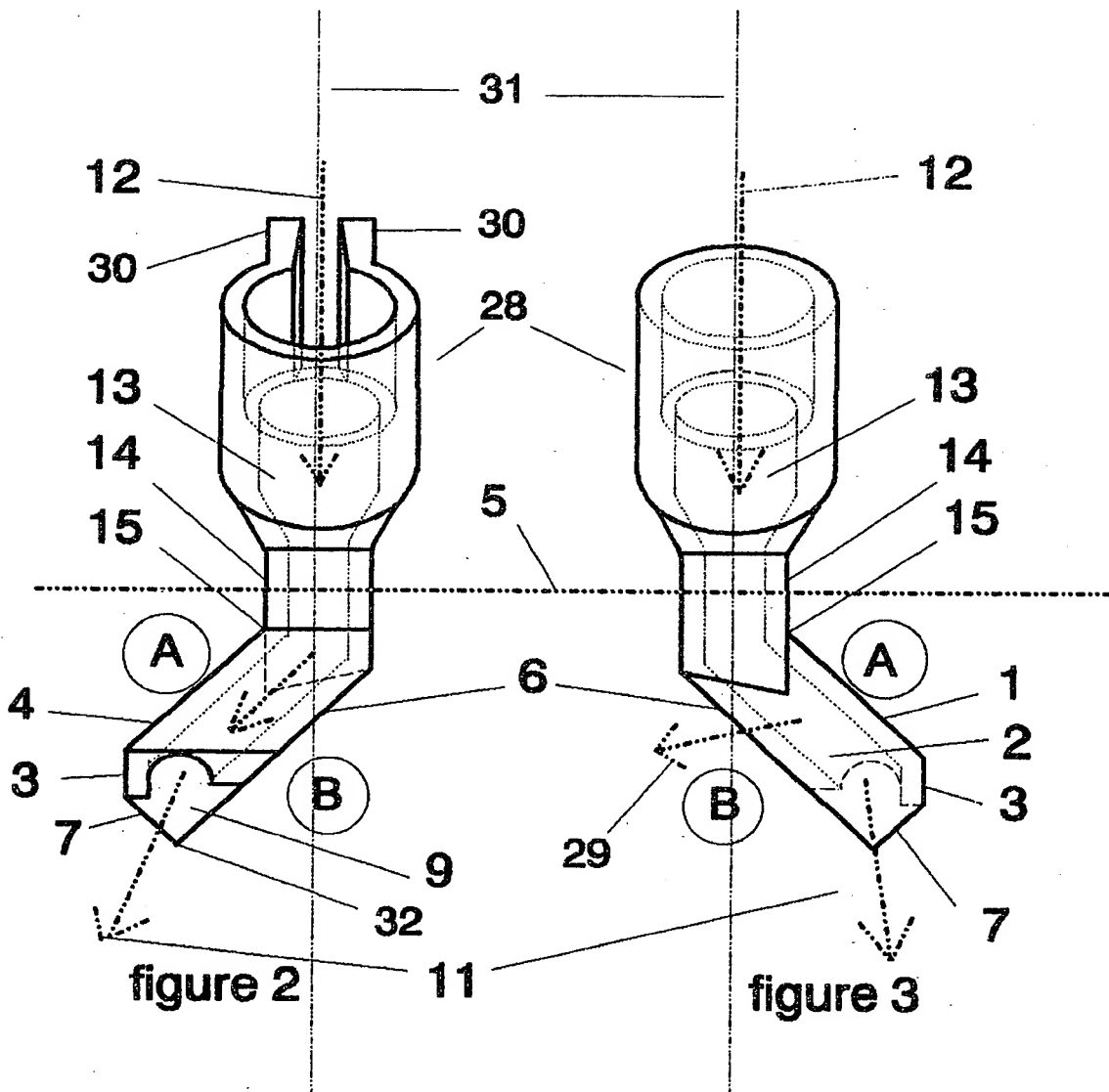
14. A method as claimed in claim 13 wherein the second material is deposited through the means used to cut and displace soil from said side-wall furrow.

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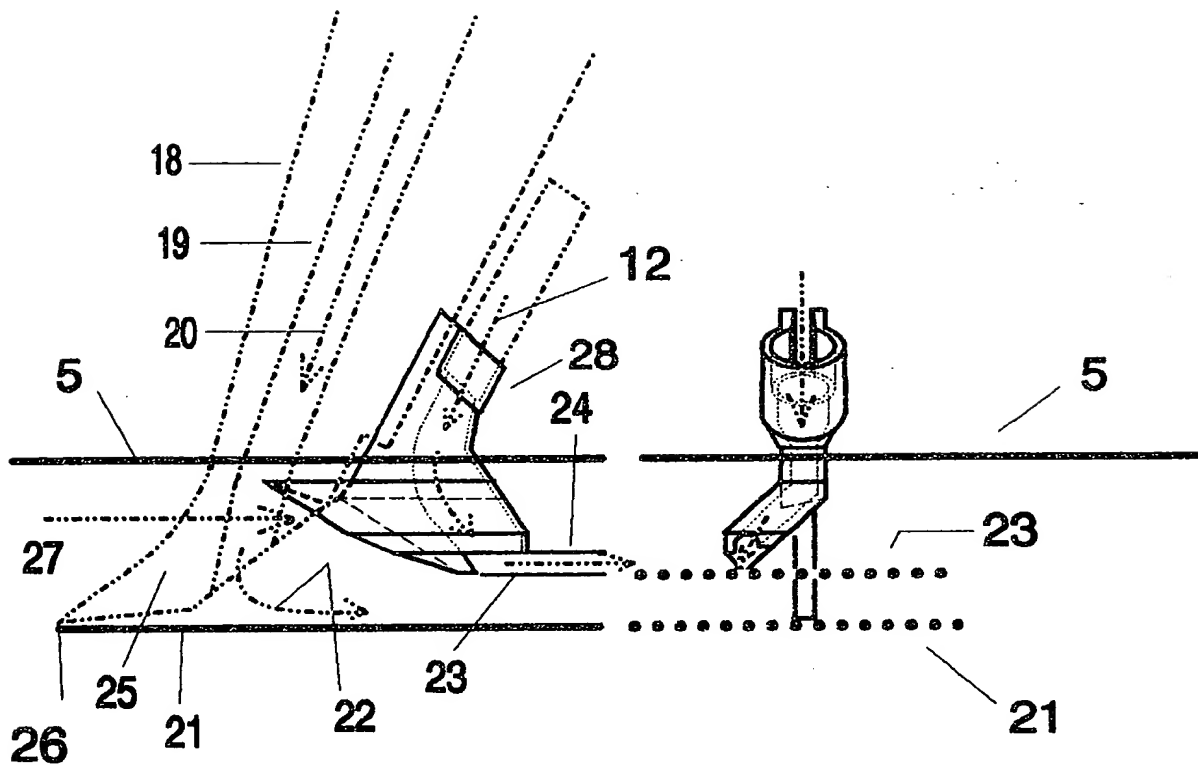


figure 5a

figure 5b

figure 5

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